Detailed Analysis of the 2008 Full River Reconnaissance of the Turners Falls Pool on the Connecticut River

Prepared for

Landowners and Concerned Citizens for License Compliance
Turners Falls Pool

Munn's Ferry picnic area

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EXECUTIVE SUMMARY

A detailed site-by-site analysis of the 2008 Full River Reconnaissance (FRR) of the Turners Falls Pool (Pool) on the Connecticut River commissioned by Landowners and Concerned Citizens for License Compliance reveal the amount of erosion in the Pool south of the state line has likely increased, significant lengths of new erosion have emerged, and many areas claimed in the 2008 FRR to have undergone natural stabilization remain unchanged since 2004. Based on the analysis of the 2008 FRR maps of riverbank erosion, new discrete erosion sites have emerged along 11,042 ft of bank south of the state line, a length that exceeds the amount of riverbank that has undergone natural stabilization. Spot-checking areas of supposed natural stabilization demonstrate erosion continues in those locations and the apparent natural stabilization is merely the result of differences in how the bank was characterized between the 2004 FRR and 2008 FRR rather than reflecting actual changes on the ground. The analysis further demonstrates the amount of erosion mapped by the 2008 FRR consistently underestimated the actual amount of erosion present in the Pool by: 1) incorporating short lengths of eroding bank into areas considered stable, 2) mapping beaches as part of the lower bank, 3) assuming previously stabilized banks remain stable, 4) using the presence of vegetation as an indicator of bank stability, and 5) conducting the mapping too quickly. Based on the 2008 FRR, the Federal Energy Regulatory Commission (FERC) issued a finding that erosion in the Pool had decreased between 2004 and 2008. The finding was likely influenced by several statements made by FirstLight Power Resources (FirstLight), the party responsible for completing bank stabilization projects in the Pool, that downplayed the level of erosion in the Pool and the influence of hydropower operations on that erosion. Given that these statements are demonstrated herein to be false, misleading, and unsubstantiated, FERC should reconsider their finding that erosion in the Pool has decreased and require FirstLight to immediately finance a new independent FRR based on a quality assurance plan approved by all stakeholders impacted by erosion in the Pool.

1.0 INTRODUCTION

The Landowners and Concerned Citizens for License Compliance (Landowners) commissioned the following report to support a complaint against the Federal Energy Regulatory Commission's (FERC) finding dated November 17, 2009 that less erosion is occurring in the Turners Falls Pool (Pool) on the Connecticut River (FERC, 2009a). Landowners was established because of concerns among landowners and other concerned citizens regarding the continued unchecked erosion in the Pool that threatens fertile farmland, conserved areas, human infrastructure, historical resources, and riparian and aquatic habitat. FERC's finding that erosion has decreased in the Pool is based on a comparison of data collected during the 2004 Full River Reconnaissance (FRR) (NEE, 2005) and 2008 FRR (Simons, 2009). Both FRRs were completed for FirstLight Power Resources (FirstLight) who currently operate the Turners Falls Dam and the Northfield Mountain Pumped Storage Project (Project). Landowners believe that FERC's finding was made in error given several statements made by FirstLight and their consultant Simons and Associates following the release of the 2008 FRR, including admissions that 1) the conclusions were based on "homogenized" data (Meeting citation 1), 2) only a "gross overall comparison" of the erosion data was made (Meeting citation 2), 3) erosion was not analyzed "site by site by site" (Meeting citation 2), 4) full river reconnaissance efforts are "not intended for year to year comparisons" (Meeting citation 1), and 5) a direct comparison between the 2004 and 2008 FRRs could not be made (Meeting citation 2).

In light of these comments, Landowners hired Dr. John Field, a fluvial geomorphologist who completed an earlier study of erosion in the Pool (Field, 2007), to test the veracity of FirstLight's claims that the 2008 FRR shows 1) the percentage of erosion has decreased between 2004 and 2008, 2) no new discrete erosion sites were identified in the Pool, 3) erosion control measures have been effective at stabilizing riverbanks and preventing erosion, and 4) efforts to reduce the rate of erosion have been definitively successful (FirstLight, 2009a). Following a brief background on the history of the Project and erosion issues in the Pool, the report presented below: 1) presents a detailed site-by-site analysis of the 2008 FRR data, 2) demonstrates the 2008 FRR underestimated the actual amount of erosion in the Pool, and 3) refutes comments by FirstLight that downplay the level of erosion and the influence of pool fluctuations on erosion. Taken together, the results of this detailed analysis of the 2008 FRR show FirstLight's claims are false, misleading, and unsubstantiated and, therefore, should compel FERC to reconsider their November 17, 2009 finding that less erosion is occurring in the Pool.

2.0 BACKGROUND

The Northfield Pumped Storage Project began operations in 1972 with a reported acceleration of erosion occurring shortly afterwards (Army Corps, 1977). Articles 19 and 20 of the FERC operating license require the Project to take reasonable measures to prevent soil erosion[1]. Considerable bank stabilization occurred in the 1970's and early 1980's using riprap and other erosion control techniques. As part of a 1998 Erosion Control Plan (ECP) that was modified in 1999, FirstLight's predecessor,

[1] Article 19 of the Turners Falls Project license states in pertinent part: In the construction, maintenance, or operation of the project, the Licensee shall be responsible for, and shall take reasonable measures to prevent, soil erosion on lands adjacent to streams or other waters, stream sedimentation, and any form of water or air pollution. Article 20 of the Northfield Mountain Project states in pertinent part: The Licensee shall be responsible for and shall take reasonable measures to prevent soil erosion on lands adjacent to the stream and to prevent stream siltation or pollution resulting from construction, operation or maintenance of the project. Cited from FERC (2009b)

Northeast Utilities Service Company, agreed to prioritize erosion sites for treatment based on the severity of the erosion. The Connecticut River Streambank Erosion Committee, recognized in Appendix G of the ECP, was established as an advisory ad hoc committee of landowners and other stakeholders to assist in planning the erosion control work to be completed under the ECP. Bank stabilization completed since the ECP was approved has consisted of bioengineering and recent and minimal preventative maintenance. Appendix G of the 1999 ECP also states that "Sufficient expenditure must be made each year to satisfactorily remedy the erosion in a reasonable manner" and that "The FERC may require changes to the plan after it has been in effect for several years. The changes may be required if it is apparent the plan is not controlling erosion, that the in-place erosion control measures are not effective, or the erosion control measures are not advancing at a rate that will not alleviate the moderate to severe erosion sites". The 1999 ECP orders that a full river reconnaissance be performed every 3-5 years to determine if the erosion is being controlled in the Pool. FERC ordered the Project to increase the rate of bank stabilization when the amount of erosion was shown to have increased between the 2001 and 2004 FRRs. FERC subsequently granted the Project a request for Rehearing of this order, but stipulated if the next FRR showed an increase in erosion, the Project would be required to amend the ECP and increase the rate of bank stabilization in the Pool (FERC, 2009b). FirstLight used the results of the 2008 FRR to show the amount of erosion in the Pool has decreased and with FERC's concurring finding dated November 17, 2009, FirstLight is not, at this time, required to modify the ECP. Since the 2008 FRR conclusions cannot be substantiated, as is demonstrated in the analysis below, FERC should reconsider its November 17, 2009 finding, which is based on those conclusions, and require FirstLight to conduct a new thorough independent FRR that accurately portrays conditions on the ground.

3.0 DETAILED ANALYSIS OF 2008 FRR DATA

Although the 2008 FRR compared the total amount of erosion with the 2004 FRR, Simons (2009) did not complete a detailed analysis of the data that can ascertain how the bank stability has changed at any given spot along the riverbanks. Maps presented in Simons (2009, p. 16-19) show the location of eroding banks in 2008. Field (2007, Appendix 7) completed detailed comparisons of previous erosion mapping efforts in the Pool using ArcView GIS computer software to overlay bank conditions from one year to the next to identify: 1) where eroding banks in one year were still eroding in another year; 2) where eroding banks became stable; 3) where stable banks remained stable; and 4) where stable banks were eroding in a subsequent year. The same approach was used to compare the 2004 and 2008 data (Figure 1). The analysis presented here and in the earlier analyses by Field (2007) extend only north to the state line, because the 1990 erosion data collected by the U.S. Army Corps extended only to this point and not to Vernon Dam at the upstream end of the Pool (Army Corps, 1991). To compare the 2008 mapping with the 2004 results, the assumption is made that a riverbank score of less than 3 in the 2008 FRR represents an eroding bank with a score of 1 or 1.5 equating to the erosion category of the 2004 FRR while a score of 2 or 2.5 equates to the moderately eroding category. A riverbank score of 3 or higher is assumed to represent a stable bank. Comparing the location of erosion mapped during the 2004 and 2008 FRRs reveals that, south of the state line, 7.6 percent (12,834 ft) of the riverbanks mapped as eroding in 2004 were mapped as stable in 2008 and 6.6 percent (11,042 ft) of the riverbanks mapped as stable in 2004 were mapped as eroding in 2008 (Figure 1). Contrary to FirstLight's (2009) claim that no new erosion sites were identified by the 2008 FRR, the 6.6 percent of riverbanks that shifted from stable to eroding between 2004 and 2008 represents 11,042 ft of new discrete erosion sites that were not present in 2004. Furthermore, given that 5,720 ft of riverbank south of the state line were stabilized through bioengineering and preventative maintenance between 2004 and 2008, 3,928 ft more of the riverbanks south of the state line were mapped as becoming destabilized compared to areas mapped as undergoing

natural stabilization (i.e., shifting from eroding to stable without the assistance of bioengineering or preventative maintenance).

4.0 UNDERESTIMATION OF THE ACTUAL AMOUNT OF EROSION

A strict reading of the erosion data might suggest that the rate of bank stabilization resulting from bioengineering and preventative maintenance is just keeping pace with the rate of erosion south of the state line (i.e., the length of riverbank mapped as becoming stable [12,834 ft] is only slightly greater than the amount mapped as becoming unstable [11,042 ft] due only to the length of riverbank stabilized through bioengineering and preventative maintenance [5,720 ft]). However, in actuality, the rate of bank stabilization is most likely not keeping pace with erosion, because at least five aspects of the 2008 FRR methodology resulted in an underestimation of the actual amount of erosion present in the Pool.

4.1 Incorporation of short lengths of eroding bank into surrounding stable areas

In Table 4 of the 2008 FRR, the length of riverbank considered stable is placed in a category called "Little to no erosion" (Simons, 2008, p. 20). This category is elsewhere clarified in the 2008 FRR as meaning "that only minor or insignificant to no erosion was observed" (Simons, 2009, p. 10). Simons (2009, p. 10) also states "Erosion is not necessarily continuous throughout the length of any particular segment of river". Furthermore, Dr. Simons, author of the 2008 FRR report, indicated that "the scale of the bank characterization was more on the order of the size of the stabilized sites (+/- 1,000 feet)" rather than the 100-foot increments used in previous FRRs (Meeting citation 2). The "little to no erosion" category is elsewhere equated with representing non-eroding banks (see Simons, 2009, Table 5) even though the 2008 FRR clearly indicates some erosion, even if minor or insignificant, is occurring within those areas. While a single short piece of eroding riverbank may seem "minor or insignificant", the total cumulative length of several short eroding segments might become quite significant when 246,282 ft of riverbank is mapped. All of these short eroding segments, and the cumulative total, are not accounted for in the 2008 FRR, because they are lumped into a non-eroding category merely due to the fact that the erosion is not continuous throughout the length of a given segment. Such short eroding segments could easily have been delineated given the 2008 FRR was conducted using "sub-meter GPS coupled with laser rangefinder for increased accuracy" (Simons, 2009, p. 1). However, since the 2008 FRR "homogenized" short lengths of erosion into the "little to no erosion" category, the 2008 FRR has underestimated, perhaps significantly, the actual amount of erosion present in the Pool.

4.2 Inclusion of beaches as part of the riverbank

The 2008 FRR considers the flat beaches that are found, in places, between the river channel and the riverbanks as part of the lower riverbank. Simons explicitly states that for the purposes of the 2008 FRR mapping "A flat lower riverbank is a beach" (FirstLight, 2009b, p. 19). This is in direct contravention of earlier FRRs and standard convention that considers the riverbank as the steep sloping land between the river channel and surrounding land surface. The beaches were never considered part of the riverbank in previous FRRs. While the semantic distinctions between what is considered the upper and lower bank may seem trivial, the results of erosion mapping will vary significantly when defining the lower bank as a beach rather than the lower portion of the steep slope bordering the river. Beaches are depositional landforms and, therefore, would rarely, if ever, be mapped as eroding even though erosion

might frequently occur on the lower portion of the adjacent banks. Consequently, by considering beaches to represent the lower riverbank, the 2008 FRR has underestimated, perhaps quite significantly, the actual amount of erosion present in the Pool.

4.3 Assumption that previously stabilized areas are not eroding

Thousands of feet of bank stabilization has occurred in the Pool since operations began at the Project in 1972. The 2008 FRR deems these previously stabilized areas as still "stable and not eroding" (Simons, 2009, p. 24). At least one of the photographs included in Simons (2009, p. 74) contradicts this claim (included here as Figure 2 for convenience). Although meant to illustrate how the bank has been stabilized by bioengineering, the photograph also shows unmistakable signs of planar slips, a common form of bank erosion observed in the Pool (Field, 2007). Continuing erosion after implementation of this bioengineering project at the Upper Urgiel site is more clearly seen in Figure 3a. Other bioengineering projects have also experienced erosion following implementation (Figure 3b-d), necessitating repairs at several sites to prevent more serious erosion problems (Field, 2007). Some of the older riprap projects completed in the 1970's are eroding more severely with significant bank recession observed behind the former line of armoring stones (Figure 4). The 2004 FRR mapped 758 ft of armored areas as eroding (Field, 2007, Table 3), providing further evidence that areas receiving bank treatments do not always remain stable. The considerable evidence for erosion at previously stabilized sites indicates Simon's (2009, p. 24) presumption that these areas remain "stable and not eroding" is not valid and, as a consequence, the amount of erosion reported in the 2008 FRR underestimates what is actually present in the Pool.

4.4 Assumption that the presence of vegetation is an indication of bank stability

Dr. Simons stated "the presence of vegetation indicates a stable bank" during a discussion of the 2008 FRR (Meeting citation 2). This is in stark contrast to an earlier more thorough study supported by FirstLight that concluded "the presence of vegetation on the bank is not necessarily an indicator of bank stability" and "the amount of bank vegetation should not be used as a variable in identifying the presence or absence of bank erosion" (Field, 2007, p. 32). By assuming that "the presence of vegetation indicates a stable bank", the 2008 FRR would inaccurately map as stable long lengths of bank in the Pool where vegetation is present. Field (2007, Figures 22, 24 and 32) highlights four areas where vegetation is present on actively eroding slopes (included here as Figure 5 for convenience), although similar conditions are present throughout the Pool. For example, the Upper Split River Farm site, on the west bank of the river just upstream of the Project tailrace, continues to erode as large slump blocks slide down the bank with large mature trees intact (Figure 6). Additionally, a detailed analysis of the 2004 FRR data revealed 30,010 ft of erosion, equivalent to 62 percent of all of the erosion in the Pool, occurred where vegetative cover was mapped as moderate or heavy (Field, 2007, Table 3). Clearly and demonstrably, erosion is occurring in the Pool where vegetation is present. Therefore, the 2008 FRR, guided by the operating assumption that "the presence of vegetation indicates a stable bank", must have underestimated, perhaps quite significantly, the actual amount of erosion present in the Pool.

4.5 Erosion mapping completed in less than 3 days

Decisions regarding which banks are eroding and which are stable are largely dependent on the "Expert Classification" of the data logger in the field (Simons, 2009, Figure 3, p. 9). The quality of such

"Expert Classification" will be necessarily compromised if the banks are viewed rapidly and from a great distance. Dr. Simons' assertion that the three days spent in the field completing the 2008 FRR "is similar to the amount of time spent on previous FRRs" (FirstLight, 2009b, p. 25) is incorrect. The three days spent mapping in 2008 is 40 percent less than the five days spent in 2004, a discrepancy that can hardly allow the two efforts to be characterized as "similar" in terms of time spent in the field. Although the 2008 effort was one day longer than the two days spent to complete the mapping in 1998, the data for the 1998 effort has not been made available, so its quality cannot be determined or analyzed. Furthermore, the amount of time spent on mapping in 1998 is of no relevance, since the 2008 FRR's conclusion that erosion in the Pool has decreased is based on comparisons with the 2004 data. Setting aside whether the two days in 1998 or even the five days in 2004 were sufficient for mapping erosion along 246,282 ft of bank, an analysis of the November 1-3 dates of mapping in 2008, detailed below, clearly show the mapping had to have been conducted too quickly to produce accurate and reliable results.

The field mapping occurred from November 1-3, 2008. A thorough mapping job would require at least this much time to become familiar with or refamiliarized with the site, calibrate the classification system with actual features observed on the ground, and establish and test a site-specific protocol for simultaneously mapping nine or more bank features. Disregarding the time needed for these essential and necessary preparations, three field days during the dates November 1-3, 2008 would have provided less than 33 hours and 50 minutes of total daylight to complete the mapping. This total time allows for an extra half hour each day before sunrise and after sunset to continue the mapping (Web citation 1). Furthermore, the weather conditions on the days of mapping were not ideal. The average temperature in nearby Orange, MA during the three days were below 40 degrees Fahrenheit with minimum temperatures of 25 degrees Fahrenheit or less (Web citation 2). Adding to the possible affects of cold are the fact that all three field days were breezy with peak winds over 20 mph or higher recorded each day. Weather conditions also limited the visibility of the banks during mapping. Full cloud cover was present November 3rd, fog or mist on November 1st and 2nd, and freezing rain or drizzle on November 2nd (Web citation 2).

To complete the 46.6 miles of mapping in less than 34 hours of daylight would require a constant boat speed of at least 1.3 mph. This speed must be considered an absolute minimum, because this estimate does not account for lunchtime, for breaks to warm hands, for traversing from one side of the river to another, for doubling back or slowing down to carefully analyze more complex locations, and for leaving and returning to a boat landing. Furthermore, the assumed speed of 1.3 mph discounts the fact that the "field work was conducted in two phases" (Simons, 2009, p. 7). The first phase "consisted of video-taping the riverbanks…on November 1, 2008" and the second phase "consisted of data-logging riverbank characteristics" from November 1-3, 2008 (Simons, 2009, p. 7-8). The implication is that two passes of the Pool were made, first to video-tape the riverbanks and a second for mapping. The amount of daylight available for the second phase would, therefore, be greatly reduced, and the boat speed for mapping necessarily increased, to account for the time spent video-taping.

While the minimum speed of 1.3 mph may not seem extremely fast, this pace would need to be maintained during the entire period of daylight while traversing close enough to the banks to simultaneously map nine bank characteristics. Little time would be available for recording the features in the data logger, because the person doing the "Expert Classification" (presumably Dr. Simons) would need to be constantly keeping his eyes on the bank to make the observations required. Even a moment spent to record data while travelling at 1.3 mph would mean that important features were being passed without observation or adequate assessment. Furthermore, "shooting the locations of where significant changes in various characteristics occurred" would require that the location be marked at the exact

position of the feature or at least at a position even with that point while moving down the river (Simons, 2009, p. 8). At a speed of 1.3 mph, a point that was observed after passing it could not be accurately "shot" and no additional time would be available to stop the boat or return to an important feature without a commensurate increase in the boat speed and decrease in the quality of observations elsewhere in the Pool.

At many locations in the Pool, trees leaning far over the bank obscure erosion occurring behind the vegetation (Field, 2007, p. 24) such that significant erosion could be mistakenly classified as stable, even in the leaf-off conditions of late Fall, if time is not taken to disembark from a boat and look at the banks from close range. Consequently, the limited field time spent on mapping has necessarily resulted in the 2008 FRR underestimating the actual amount of erosion present in the Pool.

4.6 Summary

The five aspects of the 2008 FRR methodology detailed above represent a departure from how the 2004 FRR was completed. As such, the amount of erosion mapped in 2008 would have been less than in 2004 even if no changes occurred on the ground. Given the numerous factors leading to an underestimation of the amount of erosion mapped in 2008, the amount of erosion not recorded during the 2008 FRR is potentially significant, but cannot be quantified without completion of a new, thorough, and careful full river reconnaissance conducted over weeks rather than just three days.

5.0 STATEMENTS DOWNPLAYING LEVEL OF EROSION AND INFLUENCE OF POOL FLUCTUATIONS

FirstLight and their consultant Simons and Associates made numerous statements in letters, meetings, and the 2008 FRR to downplay the level of erosion in the Pool and the influence of pool fluctuations on causing that erosion. Given that these statements may have unduly influenced FERC's finding that less erosion is occurring in the Pool (FERC, 2009a), FERC should reconsider their finding in light of the detailed information below that shows FirstLight's claims are demonstrably false, misleading, and unsubstantiated.

5.1 "There has been a trend of reduced riverbank erosion over time"

The claims of "a trend of reduced riverbank erosion over time" (Simons, 2009, p. 2), "reduced erosion in the Turners Falls Pool" (Simons, 2009, p. 2), and "the rate of erosion in the Pool is decreasing" (FirstLight, 2009a) is based on comparisons of the 2008 FRR with the 2004 FRR and earlier mapping efforts. The 2008 FRR selects the 1991 study (NDT, 1991) as a starting point when 32 percent of the banks were eroding. While the 16.7 percent of the bank mapped as eroding in 2008 (Simons, 2009) is less than 32 percent, the "trend" in reduced riverbank erosion ignores the increase in erosion between 2001 and 2004 (NEE, 2005). The actual trends since 1991 cannot be fully determined since FirstLight and their predecessors have never reported the amount of erosion mapped by Simons (1998). Furthermore, when considering a greater length of time, the 19.0 percent of erosion mapped in 2008 south of the state line is still 68 percent greater than the 11.3 percent of erosion mapped in 1978 (Army Corps, 1979), a figure suggesting a trend of increased erosion in the Pool that continues to this day.

A discussion of trends in the erosion data is meaningless, anyway, because the apparent changes in erosion from year to year are potentially an artifact of differences in mapping techniques, personnel, and other factors (Field, 2007, p. 28). FirstLight itself believes full river reconnaissance efforts are "not intended for year to year comparisons" (Meeting citation 1) and, more specifically, "a direct comparison between the 2004 and 2008 FRRs could not be made" (Meeting citation 2), so any trends drawn from that uncomparable data cannot be accurate. Therefore, the 2008 FRR claim that "there has been a trend of reduced riverbank erosion over time" cannot be substantiated, since the statement is not consistent with all of the available data and is based on multiple data sets that even FirstLight has agreed cannot be compared.

5.2 "No new discrete erosion sites were identified in the Pool"

FirstLight's cover letter accompanying the 2008 FRR claims "no new discrete erosion sites were identified in the Pool" (FirstLight, 2009a). FirstLight has no basis for making such a claim as the 2008 FRR made only a "gross overall comparison" of the erosion data and did not analyze erosion "site by site by site" (Meeting citation 2). Landowners, at their own expense, have now completed the analysis of the 2008 FRR mapping data, and the data clearly show that 11,042 ft of new discrete erosion sites have emerged south of the state line since 2004 in areas that were stable at the time of the 2004 FRR. Therefore, FirstLight's claim that "no new erosion sites were identified in the Pool" is demonstrably false and any findings by FERC based on such claims should, as a result, be revisited and revised.

5.3 "Natural stabilization processes are occurring at various locations along the Turners Falls Pool"

The 2008 FRR states "natural stabilization processes are occurring at various locations along the Turners Falls Pool" (Simons, 2009, p. 27). The 2008 FRR further describes the natural stabilization process as being characterized by "Vegetation colonizing and expanding onto a riverbank where vegetation did not exist or was sparse" (Simons, 2009, p. 27). The 2008 mapping data suggests 12,834 ft of riverbank south of the state line that were eroding in 2004 were stable by 2008 (Figure 1). While 5,720 ft of this were stabilized by bioengineering and preventative maintenance efforts, the remaining 7,114 ft of stabilization has presumably undergone natural stabilization. These areas would, therefore, be expected to show young colonizing vegetation that was not present, or largely absent, in 2004. Two of these purportedly naturally stabilized areas were spot checked to confirm whether natural stabilization had occurred at those locations as suggested by the analysis of the 2008 FRR mapping (Figure 1). At one site, on the west bank north of the Route 10 Bridge but upstream of the hydraulic influence of the bridge, an active landslide is present (Figure 7a). While some annual plants are present on the slump block, the mature trees rotated back towards the bank slope, a barren landslide scarp, and a well defined crest around the perimeter of the landslide scarp indicate active erosion is still occurring despite the presence of shallowly-rooted annuals. The second site, just north of the Munn's Ferry landing, has mature trees present along the entire bank with deep undercutting at the base indicating early stages of erosion (Figure 7b). Since the mature trees must have been present prior to 2004, the site provides no evidence that the site has stabilized since 2004. At both sites visited, no natural stabilization has occurred and the apparent changes revealed by comparing the 2004 FRR and 2008 FRR mapping are merely the result of differences in how the mapper characterized the bank rather than representing actual changes in bank stability.

The only information presented in the 2008 FRR as evidence that natural stabilization occurred in the Pool between 2004 and 2008 is a pair of photographs taken in the same area in 1998 and 2008

(Simons, 2009, p. 76 - photos provided as Figure 8 here for convenience). First, if natural stabilization is occurring at the site shown, no evidence is provided to demonstrate that the stabilization occurred between 2004 and 2008, as inferred, and not between 1998 and 2004. While the photographs are of too low a quality to definitively support any conclusions, the photographs actually appear to show that the bank is continuing to erode (Figure 8). The 2008 photograph shows the sod on the floodplain draped slightly over the top edge of the bank, indicating the bank material that was supporting the sod has been recently removed by erosion (Figure 8b). The amount of vegetation growing on the bank in both photographs does not necessarily support the contention that vegetation has increased in this area (Simons, 2009, p. 27) nor should the amount of bank vegetation be used as a variable in indentifying the presence or absence of bank erosion (Field, 2007, p. 32). The two photographs are not framed the same (i.e., the 2008 photograph shows no trees in the distance) to determine if exactly the same portion of the eroding bank is shown (Figure 8). While both photographs are of the right bank downstream of Stebbin's Island, the density of vegetation on this 2,000-foot section of eroding bank would vary across its length as different sections of bank collapse at different times. Shrubs, such as shown growing on the bank in Figure 8, can become established on actively eroding banks where the bank remains unchanged for a season or two, but the bank will become bare again as erosion continues (Field, 2007, p. 32). Consequently, the two photographs provided as evidence of natural stabilization through time more likely reflect the natural variation in vegetation density that would be expected at any given time along a 2,000-foot length of bank. If "natural stabilization processes" are occurring in the Pool, they have not been substantiated by the 2008 FRR. Claiming natural stabilization as evidence that "the rate of erosion in the Turners Falls Pool is decreasing" (Simons, 2009, p. 27) is, therefore, misleading, as most of the assumed natural stabilization is, based on spot checking of "naturally stabilized" sites (Figure 7), merely an artifact of differences in mapping methodology.

5.4 "The current erosion sites show less severe erosion than from previous years"

The 2008 FRR claims "the current erosion sites show less severe erosion than from previous years" (Simons, 2009, p. 27). To support this claim, the 2008 FRR focuses on the 20 sites that showed the greatest severity of erosion in the 1998 ECP. The 2008 FRR claims many of the 20 sites in 2008 were not "as stark in appearance" as in 1998 (Simons, 2009, p. 27) with the implication that a barren bank without vegetation represents a "stark" appearance. However, a site's visual appearance should not be construed as adequately representing its condition and stability. The Upper Split River Farm site, one of the original 20 sites listed in the ECP (Simons, 2009, p. 24), continues to have movement of large 10-foot wide slump blocks with mature trees intact (Figure 6). Ten feet of bank recession in a forested area may not appear "stark", but represents even more severe erosion, as measured by soil volume, than a barren bank where less than a foot of bank recession occurs in a single event.

The 2008 FRR explicitly acknowledges severe erosion at a site downstream of the Vernon Dam and in the vicinity of the Route 10 Bridge (Simons, 2009, p. 27). However, Dr. Simons admits short segments of "extensive" mass wasting (i.e., sites of severe erosion) were mapped as only "some" mass wasting where mixed in with segments of little to no erosion, because "of the extreme detail required to show such non-uniformity in maps" and because "mapping … on a micro-scale … would be inefficient and unproductive" (FirstLight, 2009b). Distinguishing between severely eroding and non-eroding segments that are only a few feet in length should have been possible with "sub-meter GPS coupled with laser rangefinder for increased accuracy" (Simons, 2009, p. 1), but by choosing to "homogenize" eroding and non-eroding segments into a "some" mass wasting category, the apparent amount of severe erosion is downplayed compared to what is actually present in the Pool. Recognizing that the "some" mass-wasting

category is not at all the same as a moderately eroding bank but, in fact, a combination of severely eroding and non-eroding segments is of great significance. FERC's (2009, p. 4) finding that "less erosion is occurring" in the Pool was in large measure based on FirstLight's now-discredited assurance that the differences between the "moderate" erosion category of the 2004 FRR and the "some" category of the 2008 FRR were only a "minor difference in nomenclature" (FERC, 2009a, p. 3). What remains unclear is the length of severely eroding bank that was incorporated into the "some" mass-wasting category. Several short segments of severely eroding bank thus classified could cumulatively add up to a significant total length of severely eroding bank that was not fully acknowledged by the 2008 FRR or recognized by FERC at the time of its November 27, 2009 finding. Therefore, (Simons, 2009, p. 27) claim that "the current erosion sites show less severe erosion than from previous years" is, at best, misleading.

5.5 "The projects are not the primary cause of riverbank erosion since … pool fluctuations associated with hydropower contributed 15-18% of the erosion"

To downplay the role of the Turners Falls Dam and the Project on causing erosion in the Pool, the 2008 FRR cites Army Corps (1979) as evidence that pool fluctuations contribute to only "15-18 percent of the erosion" (Simons, 2009, p.3). Although Landowners agree "no subsequent technical analysis has refuted or modified" (Simons, 2009, p. 3) the conclusions of the Army Corps (1979) study, Simons (2009) fails to acknowledge that the Army Corps (1979) study covered 141 miles of the Connecticut River from the Turners Falls Dam to Wells River, VT with the Pool representing only 15 percent of this total. Since large portions of the 141-mile study reach do not experience pool fluctuations resulting from hydropower operations, the contribution of pool fluctuations on erosion is necessarily greater than 15-18 percent in the hydropower pools themselves. Furthermore, Army Corps (1979, p. 120) states "The impacts of hydropower development on bank stability in Turners Falls Pool have been and continue to be more severe than for the other pools" and "Pool fluctuations on the order of 5 feet (in the Pool) are at least twice as destructive to banks (than) pool fluctuations of about 1-3 feet as experienced in the other hydropower pools", demonstrating that the influence of pool fluctuations on erosion in the Pool is greater than elsewhere in the 141-mile study area.

The 2008 FRR also implies that the 15-18 percent contribution of erosion caused by pool fluctuations means pool fluctuations are the cause for instability at 15-18 percent of the erosion sites with other factors responsible for erosion at the other 82-85 percent of the sites. The Army Corps (1979, p. 113) clearly states "pool fluctuations can cause an increase in instability on the order of 18 percent", indicating that pool fluctuations, where they do occur, contribute to other factors that work in concert together to destabilize the banks. In other words, a bank that is stable, despite the action of several erosive forces, could begin to erode due to the additional instability brought on by pool fluctuations. Therefore, the Army Corps (1979) study indicates pool fluctuations are a contributing factor to bank instability at all erosion sites in the hydropower pools, particularly the Turners Falls Pool, revealing that the statement "pool fluctuations … contributed 15-18% of the erosion" in the Pool (Simons, 2009, p. 3) is false and misleading.

6.0 CONCLUSIONS

The 2008 FRR concludes by stating "In sum, the current trend of decreasing length of eroding riverbanks, less severe erosion, some natural stabilization processes, and stability of previously constructed sites all combine to indicate that the rate of erosion in the Turners Falls Pool is decreasing"

(Simons, 2009, p. 27). Each point used to support the contention that erosion in the Turners Falls Pool is decreasing has been shown, in the above analysis, to be unsubstantiated, inaccurate, and/or incorrect. The supposed trend of decreasing length of eroding riverbanks does not hold over certain time periods (e.g., 2001 to 2004), fails to acknowledge erosion levels in 2008 exceed 1978 levels by more than 65 percent, and is, anyway, based on comparing data sets that even FirstLight has repeatedly admitted cannot be compared. Simons (2009) cannot claim that erosion is less severe in the Pool when severe erosion at some of the 20 sites identified in the 1998 ECP are ignored (Figure 6) and when short lengths of severe erosion are mapped only as "some" (or moderate) erosion where closely intermingled with non-eroding segments. Paired photographs of the same site do not substantiate natural stabilization processes as claimed by Simons (2009) (Figure 8). Furthermore, apparent areas of natural stabilization over time are largely the result of differences in mapping methodology between FRRs rather than reflecting vegetation colonizing and expanding onto a riverbank. Despite Simons (2009) assumption that treated banks remain stable, many of the previously constructed sites are severely eroding (Figure 4) and frequent maintenance has been required at more recently constructed bioengineering sites to prevent early stages of erosion from progressing to a more severe condition (Figure 3). Without clear supporting evidence, the 2008 FRR does not accurately represent conditions on the ground and cannot be used to identify trends in bank erosion through time. Accurate representations of ground conditions and detection of changes through time depend on site-specific and repeatable methodologies, thorough data collection by qualified individuals who are well familiarized with site conditions, and detailed micro-scale analyses.

FERC cannot be faulted for their November 17, 2009 finding that less erosion is occurring in the Pool (FERC, 2009a), since the above analysis was not available at that time. However, the site-by-site analysis of the erosion completed in Section 3.0 above indicates the length of new discrete erosion sites in the Pool south of the state line exceeds the length of bank that has undergone natural stabilization. When accounting for even a small amount of the erosion not mapped due to numerous 2008 FRR methodologies that underestimated erosion in the Pool, the rate of bioengineering and preventative maintenance cannot be considered to be keeping pace with the rate of emerging new erosion sites in the Pool. Since these findings contradict the conclusions of the 2008 FRR that were, as FirstLight admits, based only on "homogenized" data that was not thoroughly analyzed, FERC should require FirstLight to immediately finance a new FRR. The FRR should be completed by an independent consultant who is willing to prepare a quality assurance project plan to ensure an accurate representation of the actual conditions in the Pool that can be replicated in subsequent FRRs. The individuals comprising Landowners are dependent on agricultural lands by the river for their livelihoods or are legally bound by conservation agreements to protect lands along the river, so accurate representations of conditions on the ground are of paramount importance to guarantee FirstLight is meeting their obligations under the ECP and Articles 19 and 20 of the Project's operating license. Findings based on "homogenized" data, uncomparable data sets, and poorly analyzed data are unacceptable to those who suffer the financial, legal, and aesthetic consequences of continuing unchecked erosion in the Pool.

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Meeting citations

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FIGURES

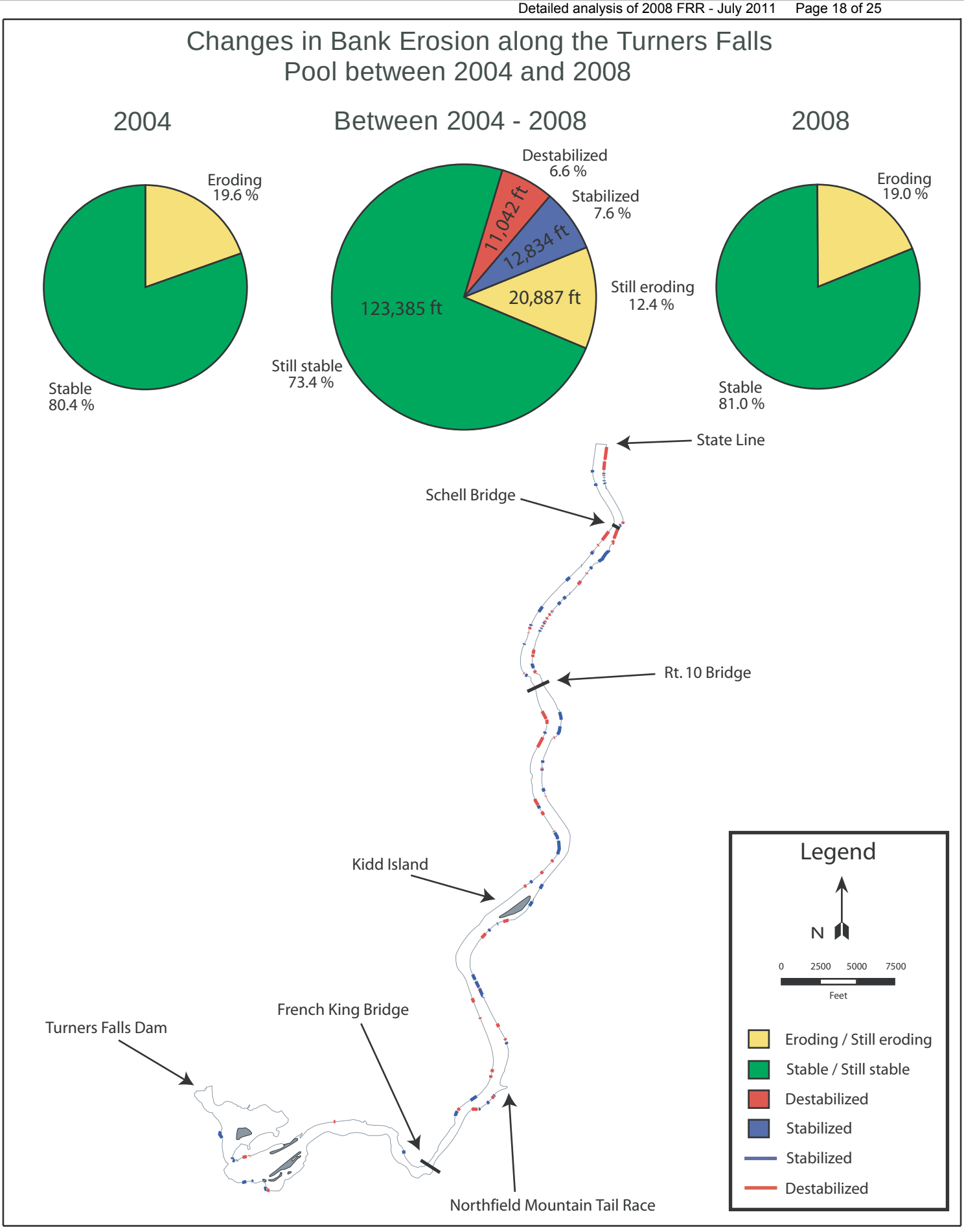

Figure 1. Comparison of the location and percentage of mapped erosion in 2004 and 2008 south of the state line.

Figure 2. Photo from Simons (2009, p. 74) showing bioengineering at the Upper Urgiel site. Arrows highlight the crest of planar slip scars indicating erosion continues at the site despite stabilization efforts.

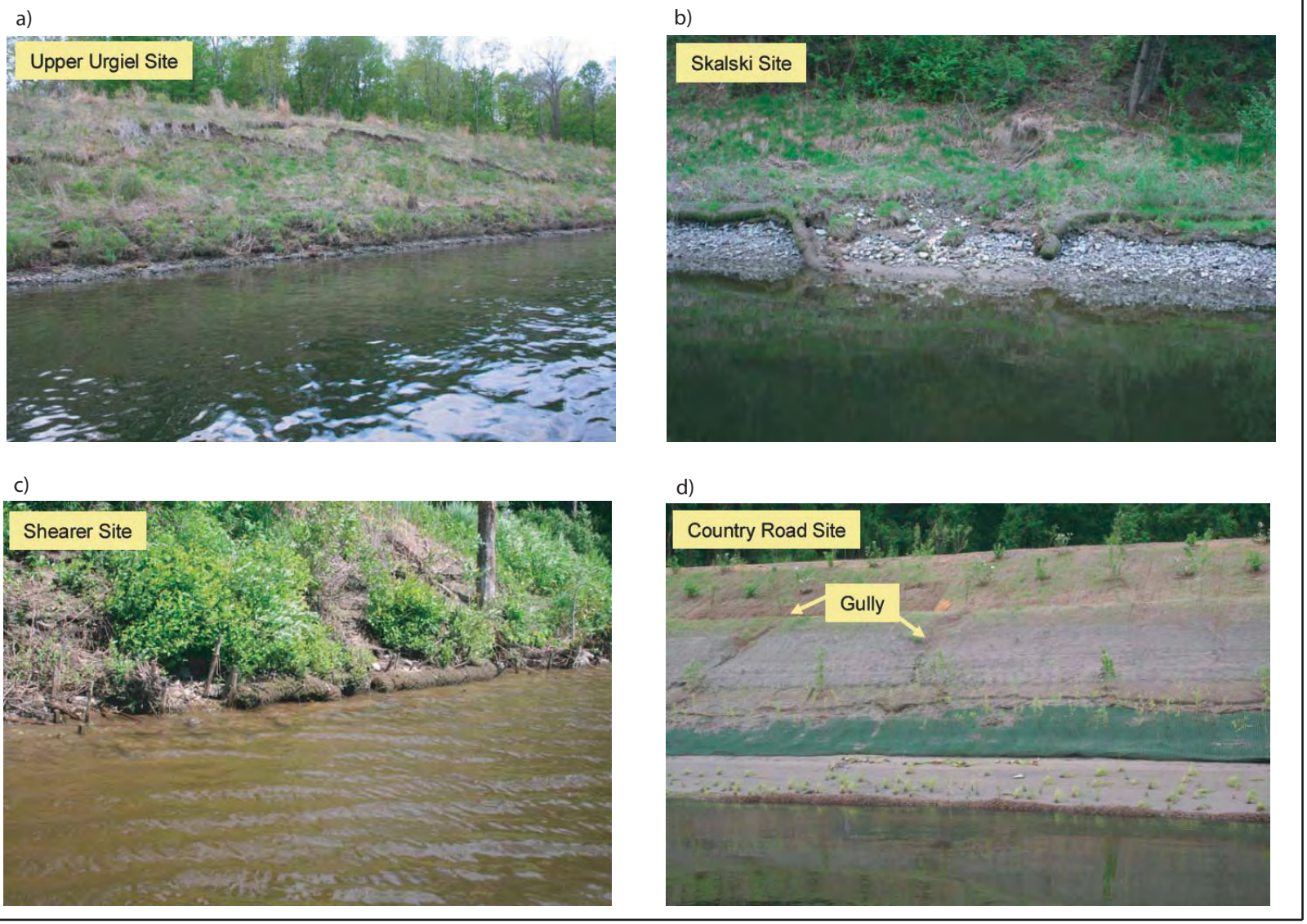

Figure 3. Photos showing instability at bioengineering sites. a) Upper Urgiel site showing planar slip failures at same site as in Figure 2, b) coir logs detached from bank by mass movements at Skalski site, c) coir logs removed by water currents at Shearer Site, and d) gullying on the slope of Country Road site. Modified from Field (2007, Figure 39).

a)

b)

Figure 4. Erosion where bank armoring occurred in the past at a) Barton Cove with dashed line indicating former position of riprap and b) Munn's Ferry picnic area. Modified from Field (2007).

Figure 5. Four examples of bank erosion occurring where vegetation is present on the bank. Modified from Field (2007).

Figure 6. Large active slump block with trees intact at Upper Split River Farm site.

a)

b)

Figure 7. Areas 2008 FRR mapping suggests have naturally stabilized between 2004 and 2008 either a) continue to actively erode or b) have mature trees growing on the bank that were present prior to 2004.

a) 1998

b) 2008

Figure 8. Paired photos of the same eroding bank from a) 1998 and b) 2008 that Simons (2009, p. 27) claims has naturally stabilized over time. Arrow highlights sod overhanging bank, indicating erosion continues at the site. Modified from Simons (2009, p. 76).